

Title: The Silver Diner

Brief Overview:

This unit will have students work with 1 inch grid paper to design polygon-shaped table arrangements for 30 people in a restaurant setting. Students will present their final product orally to the class along with oral persuasive arguments created by the group.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

• Content Standards

Algebra

- *Understand patterns, relations, and functions; and describe, extend, and make generalizations about geometric and numeric patterns.*
- *Analyze change in various contexts; investigate how a change in one variable relates to a change in a second variable; and identify and describe situations with constant or varying rates of change and compare them.*

Geometry

- *Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships; investigate, describe, and reason about the results of subdividing, combining, and transforming shapes; explore congruence and similarity; make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions; and investigate, describe, and reason about the results of subdividing, combining, and transforming shapes.*
- *Apply transformations and use symmetry to analyze mathematical situations; predict and describe the results of sliding, flipping, and turning two-dimensional shapes; and describe a motion or a series of motions that will show that two shapes are congruent;*

- *Use visualization, spatial reasoning, and geometric modeling to solve problems; build and draw geometric objects; create and describe mental images of objects, patterns, and paths; identify and draw a two-dimensional representation of a three-dimensional object; use geometric models to solve problems in other areas of mathematics, such as number and measurement; and recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life.*

Measurement

- *Understand measurable attributes of objects and the units, systems, and processes of measurement; and explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way.*

Process Standards

Problem Solving

- *Instructional programs from prekindergarten through grade 12 should enable all students to build new mathematical knowledge through problem solving; solve problems that arise in mathematics and in other contexts; apply and adapt a variety of appropriate strategies to solve problems; and monitor and reflect on the process of mathematical problem solving.*

Reasoning and Proof

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize reasoning and proof as fundamental aspects of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning and methods of proof.*

Communication

- *Instructional programs from prekindergarten through grade 12 should enable all students to organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze and evaluate the mathematical thinking and strategies of others; and use the language of mathematics to express mathematical ideas precisely.*

Connections

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize and use connections among mathematical ideas; understand how mathematical ideas interconnect and build on one another to produce a coherent whole; and recognize and apply mathematics in contexts outside of mathematics.*

Representation

- *Instructional programs from prekindergarten through grade 12 should enable all students to create and use representations to organize, record, and communicate mathematical ideas; select, apply, and translate among mathematical representations to solve problems; and use representations to model and interpret physical, social, and mathematical phenomena.*

Grade/Level:

Grades 4-6

Duration/Length:

This unit will take approximately four sixty-minute class periods.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Experience with scale
- Measuring area and perimeter
- Experience using grid paper
- Recognizing the attributes of polygons
- Cooperative learning

Student Outcomes:

Students will:

- create polygon-shaped tables using 1 inch grid paper in a restaurant to seat thirty people.
- present the final design and persuasive argument orally to the class.

Materials/Resources/Printed Materials:

- Transparencies of the grid paper and rubric
- Poster paper
- 1 inch grid paper
- scissors
- markers
- Safe-T compass for extension activity

Development/Procedures:**Day 1:**

- Read the book Spaghetti and Meatballs for All by Marilyn Burns
- Discuss the book with the class.
- Using 1-inch grid paper, explain that you are going to make scale models of the table arrangements mentioned in the book. 1 square inch will equal 2 square feet. Show the class a model of an actual 1-inch square and 2 square feet. (Teacher will need to create the 2 square foot model. See Teacher Resource 1 for the 1-inch grid paper.)
- Before students begin working, explain the “Guidelines for Creating the Polygon-Shaped Tables”. (See Teacher Resource #2.)
- You may wish to review the attributes of a polygon before students begin working.
- Have students work in pairs to design table arrangements for 6, 8, and 10 people. One person is seated on each side of the table. People cannot be seated at a corner.

- After students complete the arrangements, ask, “How many ways did you find to seat 6 , 8, and 10 people?” Each pair of students will share their work with the class. Post student work on the board.

Homework for Day 1:

- Have students use 1-inch grid paper to create and cut out seating arrangements for 12, 16, and 24 people. Paste on a separate sheet of paper. Ask the students to find as many possible table shapes for the arrangements of 12 people, 16 people, and 24 people.

Day 2:

- Explain, “Today we are going to create table arrangements for the Silver Diner, a new restaurant opening down the street from our school. Your task today is to begin thinking of possible table arrangements for the restaurant.”
- Students will work in groups to create a poster of possible table arrangements for up to 15 people. Students will cut their shapes from grid paper and glue them onto a poster. These designs can be used along with the homework from Day 1 for brainstorming ideas for Day 3.
- Review “Guidelines for Creating Polygon-Shaped Tables” from Teacher Resource #2.
- Students work in groups of 4 and share outcomes of their exploration with the class.
- Brainstorm other ideas of what would be included in a restaurant (For example: fountains, plants, lounge area, etc.) Make a list of student ideas on chart paper.

Day 3 :

- Post the student polygon table design posters along with homework from Day 1 around the classroom.
- Post the brainstorm list from Day 2.
- Explain to students that today they will design the actual table arrangements for the Silver Diner restaurant. Review “Guidelines for the Project”. (See Teacher Resource #3)
- Review “Rubric for the Silver Diner” with students (Teacher Resource #4).
- Review “Guidelines for Creating Polygon-Shaped Tables” from Teacher Resource #2. Remind students to use at least one item from the brainstorm list.
- Distribute 9 by 18 inch construction paper for the final project.

Day 4:

- Using journals students will take 15 minutes to explain why their group arrangement is the best way to seat 30 people.
- Students will share their journal entry with their small group. One person will be the recorder in the group and list the groups reasons why their model should be selected. Each person must provide at least one reason. Remind students they are writing to persuade.
- Groups will share their restaurant design and try to persuade the class why theirs is the best.

Performance Assessment:

Teacher will assess students throughout the unit based on the following criteria:

- Observation of student group work.
- Ability to represent more than one polygon model in the home assignment.
- Final model and persuasive argument presented to the group based on the rubric.
- Ability to make a scale model using conversions.

Extension/Follow Up:

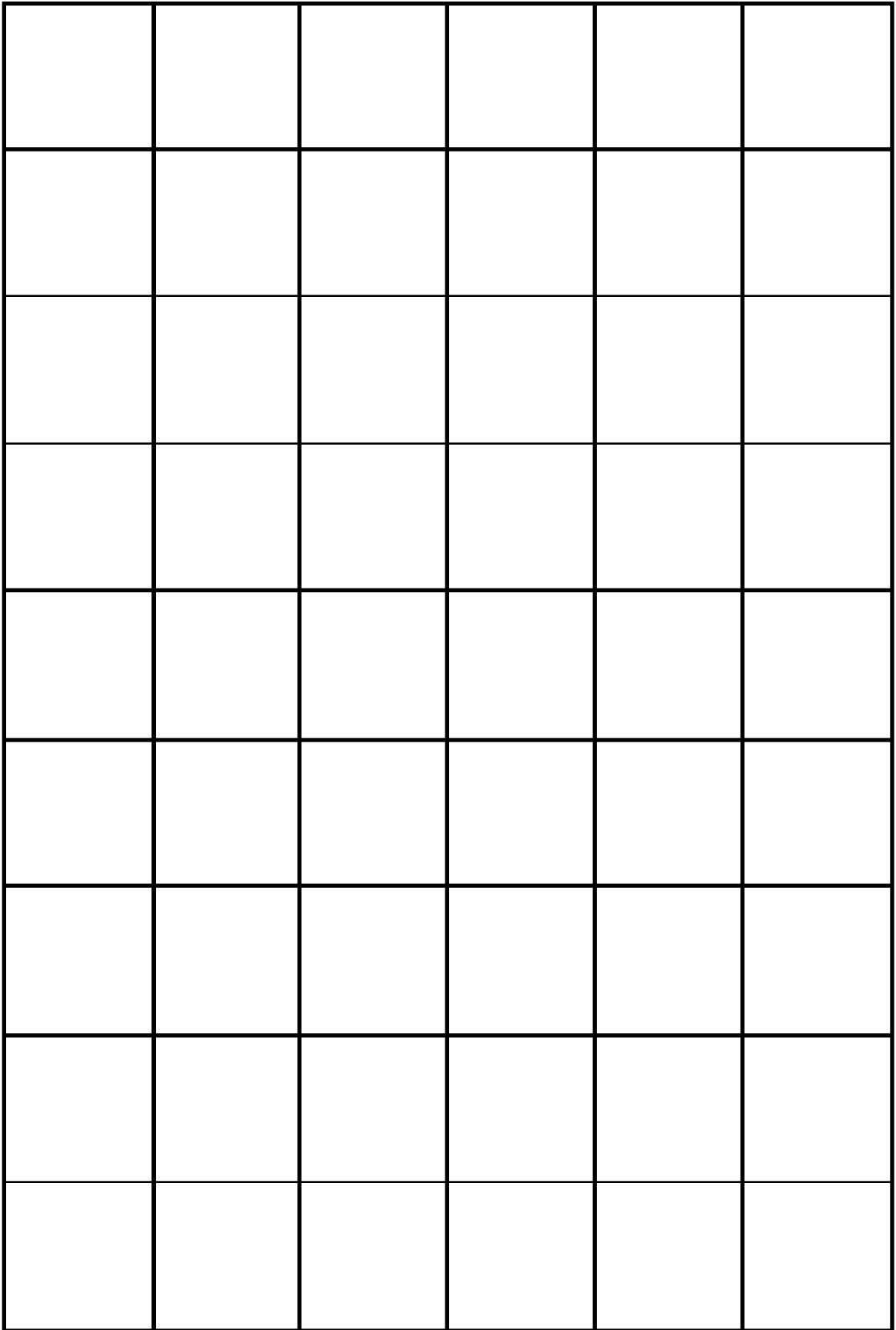
- Use circles or a combination of circles and polygons to create seating arrangements for 30 people.

Authors:

Kelly Clark
Deep Run Elementary
Howard County, MD

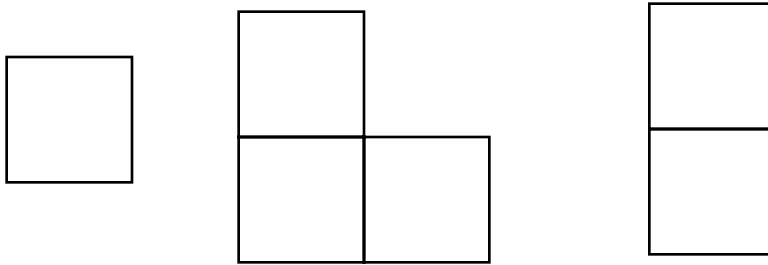
Arlinda Peoples
Lockerman-Bundy Elementary
Baltimore, MD

1 Inch Grid Paper



Guidelines for Polygon-Shaped Tables

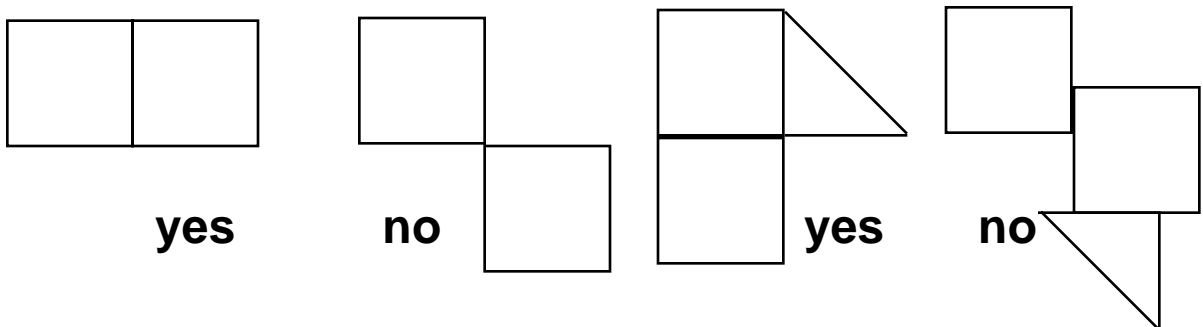
- * A table is formed by using one square or by joining two or more congruent squares to form different polygons.



- * A table can also be formed by dividing a square in half.



- * Each table that uses more than one square or triangle must share a side.

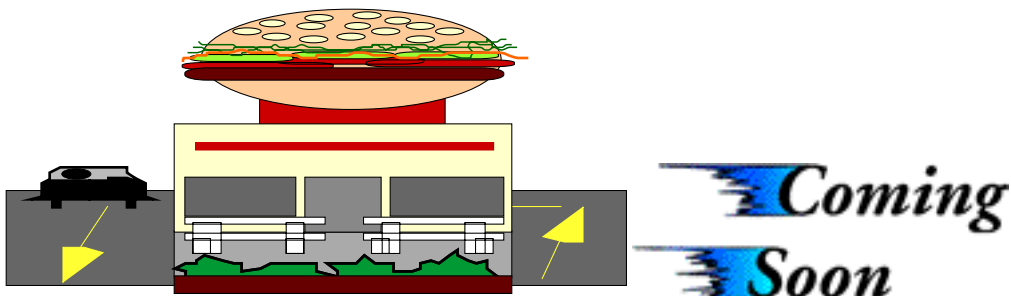


Guidelines for the Project

Remember:

* One square inch is equal to 2 square feet. You will be making scale models of your restaurant arrangement.

1. People cannot be seated on a corner of the table.
2. Each person represents two feet of table space.
3. Restaurant must provide seating for 30 people.
4. The aisle must be 4 feet wide.
5. When using more than one table, the tables must be connected on at least one side.



RUBRIC FOR THE SILVER DINER

Teacher	Student	<u>4 POINTS</u>
-----	-----	Restaurant seats 30 people.
-----	-----	4 feet of aisle space.
-----	-----	Include at least one decoration in the restaurant design (e.g., an item from the brainstorm list).
-----	-----	Oral persuasive argument needs to have one idea from each person in the group.
-----	-----	No corner seats are used.
-----	-----	2 feet per person at each table.
-----	-----	Arrangement of restaurant is clear and organized.
		<u>3 POINTS</u>
-----	-----	A three point response has all information above, except restaurant model needs to be better organized.
		<u>2 POINTS</u>
-----	-----	Students are missing two items from the 4 point list.
		<u>1 POINT</u>
-----	-----	Students are missing three items from the 4 point list.